DECLARATION

I, Kenji Hirano, of

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hereby declare that I am the translator of JP 08-075141,

a document laid open to public by Japan Patent Office on March 19, 1996,

and that the following is a true and correct translation to the best of my knowledge and belief.

Kenji Hirano

Kenji Hirano

(translator)

Date: this 22nd day of February, 2008

TRANSRATION OF JP 08-075141

(Laid open to public by Japan Patent Office on March 19, 1996)

(Note: Upper columns of page 1 of the publication are not translated because they include only bibliographic descriptions.)

(Page 1, Title of the invention and Abstract)

(54) [Title of the invention] Combustion apparatus

(57) [Abstract]

[Object] To provide a combustion apparatus of a return type suitable for practical use and constantly allowing good combustion.

[Configuration] There is provided a combustion apparatus including a return path 12 [sic] for a fuel-spraying nozzle 1. The return path is formed by an integrated unit composed of a check valve 14, an accumulator 15, a filter 16, and an oil proportional valve 20, so as to constantly perform good combustion without any worries about abnormal combustion, the apparatus having few numbers of assembly processes, with no worry about fuel leakage, and being inexpensive and easy-to-use.

(Page 2-3, Specification and claim)

[What is claimed is:]

[Claim 1] A combustion apparatus comprising:

a fuel-feed path 8 having a fuel pump 11 for supplying fuel to a fuel-spraying nozzle 1; and

a return path 12 [sic] having a check valve 14, an accumulator 15, a filter 16, and an oil proportional valve 20 and connecting a return bore 3 in the fuel-spraying nozzle 1 to a portion of the fuel-feed path 8 upstream of the fuel pump 11,

adapted to control combustion amount by controlling a returning flow of fuel by means of the oil proportional valve 20, and

characterized in that at least the check valve 14, the accumulator 15, the filter 16, and the oil proportional valve 20 are integrated into a unit.

[Detailed description of the invention]

[0001]

[Industrial field of application] This invention relates to a pressure-spraying combustion apparatus used as a burner in a water heater and the like.

[0002]

[Prior art] Conventionally, in such an apparatus as described above, fuel pressurized by a fuel pump (b) is supplied through a fuel-feed path (a) to a fuel-spraying nozzle (c), as shown in Fig. 3, while a returning flow of the supplied fuel is controlled, according to temperature of an object under control, by means of an oil proportional valve (f) provided on a return path (e) communicating with a return bore (d) of the fuel-spraying nozzle (c), so that fuel sprayed through the fuel-spraying nozzle (c) is increased or decreased, and whereby a stepless control of combustion amount is achieved.

[0003]

[Problem to be solved by the invention] In such the conventional one, it is not practical for use to be provided only with the oil proportional valve (f) on the return path (e). Specifically, it is necessary to be provided with an accumulator for restraining spray pulsation originating from the fuel-spraying nozzle (c) so as to reduce noise in burning, a filter for removing dust mixed in a returning fuel, and a check valve for preventing drop of fuel from the fuel-spraying nozzle (c) in not burning. Connection of these components as described above one-by-one to one another on an assembly line of combustion apparatus requires increased number of processes, thus rendering more expensive, and accounts for the increased risk of fuel leakage.

[0004]

[Means to solve the problem] This invention focuses its attention on the above mentioned problems, and in order to solve the above-mentioned disadvantages, provides in its configuration a fuel-feed path having a fuel pump for supplying fuel to a fuel-spraying nozzle and a return path having a check valve, an accumulator, a filter, and an oil proportional valve and connecting a return bore in the fuel-spraying nozzle to a portion of the fuel-feed path upstream of the fuel pump, is adapted to control combustion amount by controlling a returning flow of fuel by means of the oil proportional valve, and integrates at least the check valve, the accumulator, the filter, and the oil proportional valve into a unit.

[0005]

[Function] Fuel having been pressurized now by operation of a fuel pump 11 is supplied to a fuel-spraying nozzle 1, part of the fuel being returned via a return path 12 [sic] without being sprayed from the fuel-spraying nozzle 1 by the operation of an oil proportional valve 20, and the rest being sprayed to be burned. Fuel amount to be returned by the oil proportional valve 20 is controlled so as to control combustion amount.

[0006] The fuel being flown into the return path 12 [sic] at this time, flowing through the check valve 14 for allowing flow to the oil proportional valve 20 but preventing backflow to the fuel-spray nozzle 1, the accumulator 15 for adjusting pressure, and the filter 16 for removing dust, is controlled by the oil proportional valve 20, so as to remove combustion noise and dust in the fuel and to certainly prevent fuel drop after combustion. Further, the check valve 14, the accumulator 15, the filter 16, and the oil proportional valve 20 are integrated in this order into a unit, so as to need fewer number of processes, provide the apparatus inexpensively, and allow the apparatus to be used with a sense of security and without any worries about fuel leakage.

[0007]

[Preferred embodiments] Now, a combustion apparatus relating to this invention will be described below, referring to a preferred embodiment shown in Figs. 1 and 2. Numeral 1 denotes a fuel-spraying nozzle of a fuel return type provided with a distributor 4 having a return bore 3 formed in its center within a nozzle holder 2. A swirling chamber 7 is formed at a distal end of the distributor 4 and in a distal end portion of the nozzle holder 2, which has a spraying opening 5. Fuel flown through a swirling groove 6 on a peripheral wall of the chamber 7 is sprayed in a swirl into the swirling chamber 7.

[0008] Numeral 8 denotes a fuel-feed path connecting a fuel tank 9 and an inlet 10 of the fuel-spraying nozzle 1, provided with a fuel pump 11 for pumping fuel at a constant pressure and a pressurizing pump 12 for compressing air mixed in a returning fuel returned from a return path described below so as to prevent pulsating combustion.

[0009] Numeral 13 denotes a return path connecting the return bore 3 in the distributor 4 to a portion of the fuel-feed path 8 between the fuel pump 11 and the pressurizing pump 12, the return path having thereon the followings in this order from the fuel-spraying nozzle 1 side: (1) the check valve 14 for preventing backflow of fuel from the return path 12 [sic] to the fuel-spraying nozzle 1, (2) the accumulator 15 consisting of a diaphragm for restraining spray pulsation originating from the pump 11 so as to reduce noise in burning, (3) the filter 16 for removing dust mixed in the returning fuel, and (4) the oil proportional valve 20 consisting of an electromagnetic coil 17, a valve body 18, a spring 19, and the like, so that a stepless combustion is achieved in response to a required heat generation, with combustion amount at the fuel-spraying nozzle 1 determined, by controlling a returning flow by adjusting an opening degree of the valve 20.

(Note: (1) to (4) are added only for facilitating understanding, because the original Japanese language sentence is long and complicated.)

[0010] Further, the check valve 14, the accumulator 15, the filter 16, and the oil proportional valve 20 are integrated into a unit so as to form the return path 12 [sic], being easily incorporated in an combustion apparatus only by connection to two portions, i.e., the fuel-spraying nozzle 1 and the fuel-feed path 8, and constitute combustion apparatus having various capacities only by changing of the fuel-spraying nozzle 1 and the electromagnetic [sic] pump 11, so that combustion apparatus are developed easily and in a short period of time.

[0011] Now, operations of the above-mentioned embodiment will be described below. Upon an appropriate operation for combustion initiation, the fuel pump 11 starts driving at a constant pressure so as to supply fuel in the fuel tank 9 to the fuel-spraying nozzle 1 via the fuel-feed path 8, and the oil proportional valve 20 is controlled according to deviation of a hot water temperature, which is the object of control, from a preset temperature so as to perform combustion at the fuel-spraying nozzle 1 in response to required heat by returning excess fuel to the fuel-feed path 8 via the return path 12 [sic].

[0012] The fuel having flown into the return path 12 [sic] at this time passes through the check valve 14, where backflow is prevented, the filter 16, where dust mixed in the fuel is removed, and the accumulator 15 located on opposite side of the filter 16, where excess pressure is eliminated so as to prevent pulsating combustion, and then flows into the oil proportional valve 20. That certainly prevents fuel drop after combustion, combustion noise, and abnormal combustion and constantly performs good combustion for use with a sense of security.

[0013] Further, since the check valve 14, the accumulator 15, the filter 16,

and the oil proportional valve 20 are integrated into a unit, combustion apparatus are assembled on an assembly line only by connection at two sites, i.e., between the fuel-spraying nozzle 1 and the check valve 14 and between the fuel-feed path 8 and the oil proportional valve 20. That needs fewer number of processes, provides the apparatus inexpensively and without any worries about fuel leakage because of few connection points, and allows the apparatus convenient with easy handling.

[0014] Though in this embodiment, the four components, i.e., the check valve 14, the accumulator 15, the filter 16, and the oil proportional valve 20 are integrated into a unit, the fuel-spraying nozzle 1, the fuel pump 11 and/or the pressurizing pump 12 may be added to the unit, so as to increase components of the unit to include five or six components. The increased components bring greater effects.

[0015]

[Effect of the invention]

In short, this invention includes the fuel-feed path 8 having the fuel pump 11 for supplying fuel to the fuel-spraying nozzle 1 and the return path 12 [sic] having the check valve 14, the accumulator 15, the filter 16, and the oil proportional valve 20 and connecting the return bore 3 in the fuel-spraying nozzle 1 to the portion of the fuel-feed path 8 upstream of the fuel pump 11, adapted to control combustion amount by controlling a returning flow of fuel by means of the oil proportional valve 20, and integrating at least the check valve 14, the accumulator 15, the filter 16, and the oil proportional valve 20 into a unit, so as to certainly prevent pulsating combustion or combustion noise, further to prevent abnormal combustion caused by invasion of dust or fuel drop after combustion. Thus, the invention provides a combustion apparatus of a return type suitable for practical use inexpensively, with the extremely few numbers of assembly processes, with no worries about fuel

leakage, and being constantly for use with a sense of security.

[Brief descriptions of the figures]

[Fig. 1] A configuration diagram of a combustion apparatus provided with an embodiment of the invention.

[Fig. 2] A schematic diagram of an essential part of the embodiment.

[Fig. 3] A configuration diagram of a conventional system.

[Descriptions of numerals]

1. fuel-spraying nozzle
3. return bore
8. fuel-feed path
11. fuel pump
12 [sic]. return path
14. check valve
15. accumulator
16. filter
20. oil proportional valve

(Note: Figs. 1 to 3 are omitted because they include no word other than figure numbers. A bottom column of page 4 is not translated because it includes only information of an inventor.)

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